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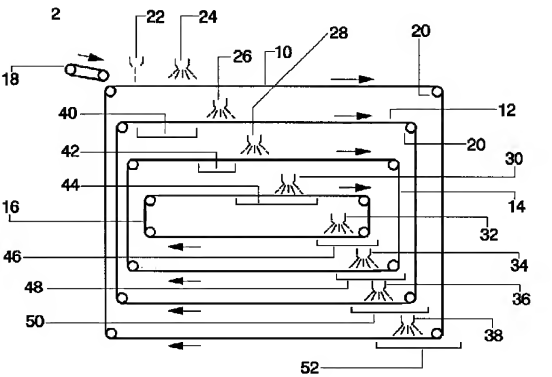
(54) **METHODE SERVANT A TRAITER LES VIEUX PAPIERS, ET DISPOSITIF CONNEXE**

(54) **METHOD AND DEVICE FOR PROCESSING WASTEPAPER**



(57) L'invention concerne un appareil servant à désintégrer en fibres individuelles du papier de rebut en vrac et à éliminer les contaminants des fibres. L'appareil fait appel à une série de jets d'eau à haute pression et à une batterie de cribles rotatifs de différentes grosseurs de maille. Les jets haute pression servant à désintégrer le papier de rebut sont placés au-dessus des parties supérieures des cribles. Les cribles sont disposés de manière que ceux à mailles plus petites se trouvent sous ceux à mailles plus larges, ceux à trame plus grossière se trouvant au-dessus et ceux à trame plus fine au-dessous. L'appareil comprend des moyens de cribler et de laver les fibres désintégrées et d'éliminer les contaminants des fibres utiles.

(57) An apparatus for disintegrating bulks of wastepaper into individual fibers and for removing contaminants from the fibers comprises a series of high-pressure water jets and a series of endless revolving screens of different mesh sizes. The high-pressure jets for disintegrating the wastepaper are positioned above the upper parts of the screens. The screens are configured in such a way that the screens of finer mesh sizes are located below those of larger mesh sizes with the coarsest screen at the top and the finest screen at the bottom. The apparatus combination has means to screen and wash the disintegrated fibers, and remove contaminants from the usable fibers.

ABSTRACT OF THE DISCLOSURE

An apparatus for disintegrating bulks of wastepaper into individual fibers and for removing contaminants from the fibers comprises a series of high-pressure water jets and a series of endless revolving screens of different mesh sizes. The high-pressure jets for disintegrating the wastepaper are positioned above the upper parts of the screens. The screens are configured in such a way that the screens of finer mesh sizes are located below those of larger mesh sizes with the coarsest screen at the top and the finest screen at the bottom. The apparatus combination has means to screen and wash the disintegrated fibers, and remove contaminants from the usable fibers.

METHOD AND DEVICE FOR PROCESSING WASTEPAPER

Background of the Invention

This invention relates to the processing of wastepaper, and more particularly to methods of and device for disintegrating a bulk of wastepaper into individual fibers and separating these individual fibers from contaminants such as metals, plastics and ink particles, etc.

The invention is especially concerned with the disintegration of bulks of wastepaper, and more particularly old newspaper, old magazine, computer printouts, mixed office wastepaper, paperboard, carton and any other types of preconsumer and postconsumer paper product, to produce pulp fibers for making new paper, paperboard or carton, etc.

Heretofore, conventional practice for processing wastepaper for paper or board production has involved the mechanical disintegration of said wastepaper using a pulper (an disintegrator used in the pulp and paper industry for repulping wastepaper) equipped with revolving blades, water and chemicals such as sodium hydroxide and dispersing agents, etc.; the screening to remove coarse contaminants such as metal and plastics, etc.; the high density cleaning using hydrocyclone to eliminate smaller contraries such as metal, sands, grits, etc.; the flotation cell to remove ink particles; and the washing to eliminate fine ink particles and fillers. Such a conventional method requires large capital investment and high operating costs.

Industrial uses of high-pressure water jets for cleaning, mining and debarking of wood logs, etc., are well known. In a Canadian patent application (No. 2,098,515, June 16, 1993) Ali taught the use of liquid stream with or without chemicals and temperatures to make pulp from cellulosic materials like wood, waste papers and non-wood plants. Ali's

technique teaches us how to disintegrate a primary cellulosic material into a secondary material of different form and size for further treatment by conventional means, but it does not teach us, for example in the case of waste papers, how to separate useful fibers from contaminants.

One of the objects of this invention is the provision of an improved method of more economically transforming wastepaper into individual fibers for making new paper or any other kinds of fibrous products. Another object is the provision of such methods that may effect improved economy by reduction of initial equipment cost, reduction of energy consumption and elimination of chemical cost. It is also the object of this invention to provide a method that, in addition to the stated economic advantages, produces fibers of requisite quality for manufacturing good quality paper and any other types of paper product.

Theory of the Invention

Wood fibers are hygroscopic in nature; they form paper via the chemical bonds called hydrogen bonds between individual fibers during a drying process. Inversely, the inter-fiber bonds can be weakened and removed by subjecting the paper to an environment of liquid water or water vapor. When a sheet of paper, in which the fibers are de-bonded, is subjected to an external force, such as a high pressure water jet, the individual fibers can be released producing a pulp slurry.

When a bulk of wastepaper, which may contain various kinds of contaminants such as ink, adhesive tapes, plastics and metal, etc., is placed on a screen with relatively large mesh size and subjected to a high-pressure jet of water, which provides both the wetting effect and the mechanical force required for de-bonding and liberating the fibers, de-fiberization takes place

reducing the bulk of wastepaper into a pulp slurry or suspension. Under the influence of such a high-pressure jet of water, the released individual fibers and the small contaminants, such as ink particles, are forced through the wire meshes, leaving the coarse contaminants on the screen. Such a method of treatment of wastepaper achieves three important functions of de-fiberization of the bulk of wastepaper, dislodging ink particles from fiber surface and screening out the large contaminants. Using multiple combinations of high-pressure water jets and screens of different mesh sizes, it is possible to produce a clean pulp suitable for making paper or for further processing. In fact, one can achieve these three principal purposes, namely de-fiberization, screening and washing, without the use of expensive equipment such as pulpers, screens, hydrocyclones, flotation cells and press washers, etc. as in conventional de-inking processes.

Brief Description of the Invention

In general, the method of this invention involves reducing a bulk of wastepaper to individual fibers suitable for use in the manufacture of new paper or any other kinds of paper product. The method comprises the procedures of placing the bulk of wastepaper on an endless revolving screen of suitable mesh size, subjecting it to a high-pressure liquid jet and affecting a movement of the screen so that the liquid jets continuously impinge on the bulk of wastepaper. As the liquid impacts onto the bulk of wastepaper, the printed ink is reduced to fine particles and dislodged from the fiber surfaces, while the individual fibers are simultaneously liberated from the bulk and forced through the screen with meshes larger than the length of the liberated fibers. The resistant contaminants such as plastic materials having a

dimension larger than the mesh sizes remain on the revolving screen and are removed by gravity and a water shower.

The liberated fibers and the smaller contaminants that passed through the first coarse screen are retained on a second endless revolving screen of finer mesh size, located underneath the first coarse screen, and subjected to high-pressure water jets that effect further de-fiberization, screening and washing actions that may be further repeated using finer screens.

One of the embodiments of this invention comprises a series of three or more endless revolving screens configured in such a way that the screens with larger mesh sizes are positioned above those of smaller mesh sizes; the coarsest one being on the top of all the others and the finest one at the bottom.

In another aspect of the invention, means are provided to recover, treat and re-utilize the white water used in the system, to minimize the consumption of water.

Specific Description of the Invention

The invention, as exemplified by a preferred embodiment, is described with reference to the drawings in which:

Figure 1 is a sectional view of an embodiment of an apparatus of the invention;

Figure 2 is a perspective view of part of the apparatus shown in Figure 1;

Figure 3 is a perspective view of part of the apparatus shown in Figure 2.

Referring to drawings, the embodiment of the invention shown, an apparatus **2** comprises a conveyor **18**, four endless screens **10, 12, 14** and **16**,

one narrow angle high-impact water jet **22,** four high-pressure washing jets **24, 26,28 30,** four intermediate-pressure washing jets **32, 34, 36, 38**, three white waters (used water) collectors **40, 42, 44**, one accept collector **46,** and three reject collectors **48, 50, 52.**

The conveyor **18**, located at the top end of the coarsest screen **10,** is used to continuously feed the apparatus **2** with wastepaper **58**, and it revolves in the same direction as the screens **10, 12, 14, 16** do.

The screens **10, 12, 14 16** are configured in such as way that the finer ones are positioned below the coarser ones, with the coarsest one **10** on the top and the finest one **16** at the bottom. The screens **10, 12, 14, 16** are supported by motorized rolls **20**.

The high-impact water jet **22** is located near the feeding end of the coarsest screen **10,** while the high-pressure washing jet **24** is located immediately after the high-impact water jet **22**. The high-pressure washing jets **26, 28, 30** are, respectively, located above the screens **12, 14, 16**. These high-pressure washing jets **24, 26, 28, 30** are positioned in series without overlapping each other. The high-pressure washing jets **24, 26, 28** are used to washed the fibrous material through meshes **56** of the screens **10, 12, 14,** while the high-pressure washing jet **30** is used to wash off the fine contaminants, such as ink particles, from the de-fiberized wastepaper.

The intermediate-pressure washing jets **32, 34, 36, 38,** are located, respectively, above the lower part of the screens **16, 14, 12, 10.** The washing jets **32** is used to remove the accept of fibers from the finest screen **16** into the accept collector **46**, while the washing jets **34, 36, 38** are used to wash off the contaminants on the respective screens **14, 12, 10** into the respective reject collectors **48, 50, 52**.

The white water collectors **40, 42, 44** are, respectively, located under the screens **12, 14, 16.** The white water collectors **40, 42** under the screens **12** and **14,** respectively, are positioned immediately before, but not directly under, their respective high-pressure washing jets **26, 28.** However, the white water collector **44** located under the finest screen **16** is extended to cover the area directly under the high-pressure washing jet **30.**

In order to disclose more clearly the nature of the present invention, the following example illustrating the invention is given. It should be understood, however, that this is done solely by way of example and is intended neither to delineate the scope of the invention nor limit the ambit of the appended claims.

This example illustrates the de-fiberization of a bulk of wastepaper **58** on a revolving coarse screen **10** under a mechanical force of the high-impact water jet **22.** As the wastepaper **58** moves forward it is subjected to the action of the high-impact water jet **22.** The highly concentrated water particles **54** strike onto the fibers **60** stretching across the meshes **56** of the screen **10.** With the wires **62** of the screen **10** acting in opposite direction of the water particles **54,** the fibers **60** of the bulk of wastepaper **58** are de-bonded and liberated either individually or in bundles, or in flakes. Under the mechanical force of the high-impact water jet **22,** the partially de-fiberized wastepaper passes through the meshes **56** of the coarse screen **10** and onto the revolving finer screen **12,** while larger bundles of fibers will be further de-fiberized by the high-pressure washing jet **24** and forced through the meshes **56** of the coarse screen **10.** The fully liberated fibers and the partially de-fiberized wastepaper (or fiber bundles) deposited onto the finer screen **12** are subjected to the action of the high-pressure washing jet **26.** These de-fiberization and washing actions are repeated on screens of finer mesh sizes **14, 16.** The

accept of pulp fibers is doctored off by means of the intermediate-pressure washing jet **32** and collected by the accept collector **46**. Any large contaminants that cannot be broken down by the high-impact water jet **22** and the high-pressure washing jets **24, 26, 28** are removed by the intermediate-pressure washing jets **34, 36, 38** and collected by the respective reject collectors **48, 50, 52.** The fine ink particles are received by the white water collectors **40, 42, 44.**

A feature of the apparatus combination **2** of this invention is its ability to disintegrate a bulk of wastepaper into individual fibers suitable for manufacturing new paper products and remove the contaminants from the usable fibers.

Although only a single embodiment of the present invention has been described and illustrated, the present invention is not limited to the feature of this embodiment, but includes all variations and modifications within the scope of the claims.

Claims:

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A process for mechanically de-fiberizing a bulk of wastepaper which comprises:

(a) submitting waste papers or any paper products to a motorized feeding conveyor which transfers said material onto a revolving endless coarse screen constituting the top-most screen of a series of at least three or more superimposed endless screens with decreasing mesh size;

(b) subjecting the waste papers on the endless coarse screen to high-impact water jets, two or more in number and applied only to top side of the uppermost endless coarse screen, located at a distance immediately after the depositon of waste paper on the coarse screen, close to the feeding conveyor, for successive disintegration and separation of fibers from contaminants through said series of superimposed endless screens having successively finer mesh sizes, and at the same time subjecting fibrous mass on each said screens to one or more high-pressure water jets applied to the top side of each of the superimposed endless screens, to further disintegrate the fibrous mass into individual fibers and separate them from larger contaminants;

(c) removing from each screen, except the finest screen, fibrous particles and contaminants not passing through that screen and recovering said materials for reprocessing and/or for disposal;

(d) collecting disintegrated individual fibers remained on the finest screen for papermaking;

(e) recovering white water passing through said screens.

2. The process combination of claim 1, wherein the conveyor for feeding waste paper onto the coarse screen is located, slightly above an upper part of the endless coarse screen, at a feeding end of said process combination, revolves in the same direction as the superimposed endless-screens, and has means to control its revolving speed.

3. The process combination of claim 1, wherein the superimposed endless-screens composing of at least three or more screens of different mesh sizes ranging from coarse to fine, all revolving in the same direction, are configured with screens having smaller mesh sizes located below an upper part but above a lower part of screens of larger mesh sizes, with a coarsest screen enclosing screens of smaller mesh sizes and with the finest screen in the central position of said combination.

4. The process combination of claim 3, wherein said screen sizes range from 2 meshes for the coarse screen and 200 meshes for the fine screen, and intermediate screens are those having a mesh size in between.

5. The process combination of claim 1, wherein the endless-screens are supported and revolved by means of motorized rolls which have means for controlling their revolving speeds.

6. The process combination of claim 1, wherein the high-impact water jets, two or more in number and applied only to the uppermost endless coarse screen, are located at a distance immediately after the deposition point of waste paper on the coarse screen which is the top-most screen of the series of superimposed endless screens, near the feeding end of said combination and

above the upper part of said coarsest screen, and have a pressure ranging from 1 to 5000 psi.

7. The process combination of claim 1, wherein high-pressure washing jets, two or more in number and applied to each screen of the superimposed system, are located successively away from the feeding end of said combination, above upper part of each screen of the superimposed screens having mesh sizes ranging from coarse to fine, and have a pressure ranging from 1 to 3000 psi.

8. The process combination of claim 1, wherein intermediate-pressure washing jets are located opposite to the feeding end of said combination, above lower parts of said superimposed screens, but not directly under said high-pressure washing jets, and have a pressure ranging from 1 to 2000 psi.

9. The process combination of claim 1, wherein white water passing through the screens of intermediate and fine mesh sizes is collected using collectors which are installed successively away from the feeding end of said combination, underneath the upper parts of said superimposed screens of intermediate and fine mesh sizes, but not directly under said high-pressure washing jets located above the upper parts of said superimposed screens, except for the white water collector underneath the upper part of the finest screen where a white water collector is extended to cover the area under said high-pressure washing jet located above the upper part of said finest screen, and which are capable of removing liquid from said screens and discharge the same.

10. The process combination of claim 1, wherein disintegrated fibers remained on the finest screen are removed from the screen using a washing jet of intermediate pressure and collected in an accept collector which is located opposite to the feeding end, directly under an intermediate-pressure washing jet located above the lower part of said finest screen, and below the lower part of said finest screen, and which has means to receive fibrous material and liquid and to discharge the same.

11. The process combination of claim 1, wherein the un-disintegrated fibrous particles and contaminants are removed from screens of coarse and intermediate mesh sizes by means of intermediate-pressure washing jets located opposite to the feeding end of said combination, above lower parts of said screens of intermediate and coarse mesh sizes, and are collected by reject collectors which are located directly under said washing jets and below the lower parts of said screens, and which have means to receive rejected material and liquid, and discharge the same.

Fig. 1

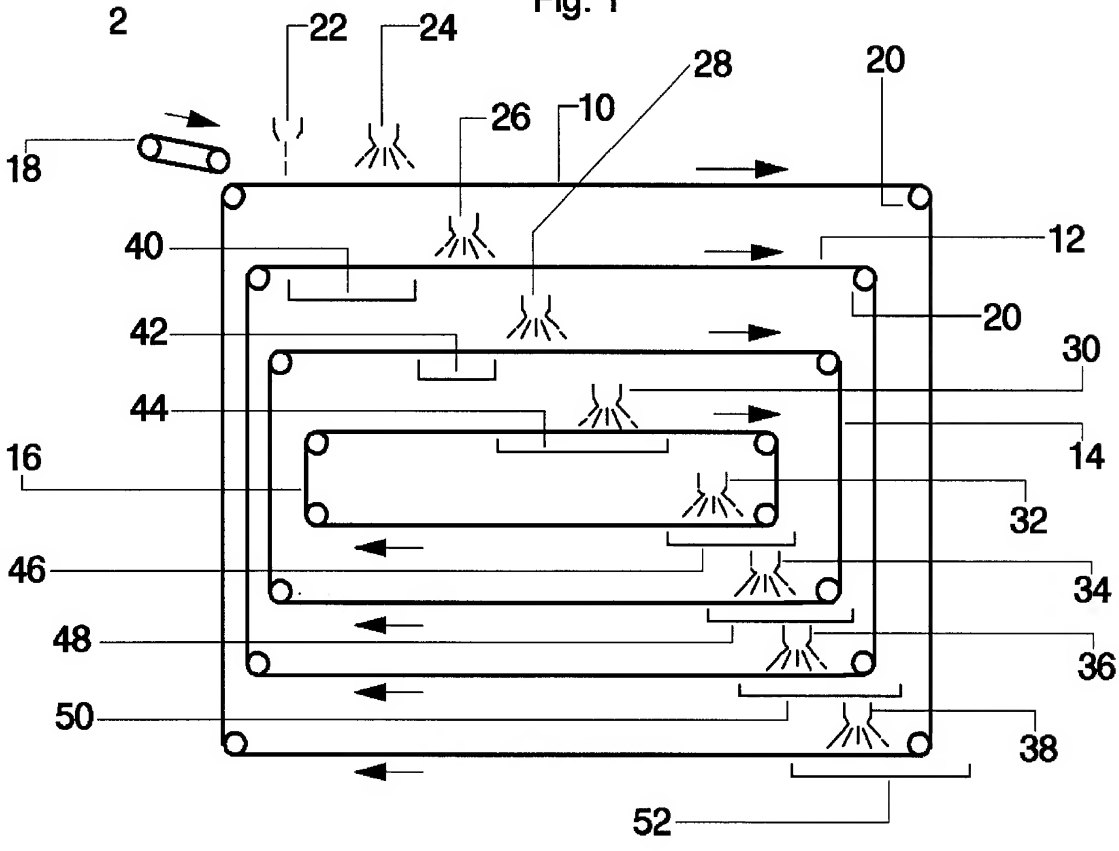


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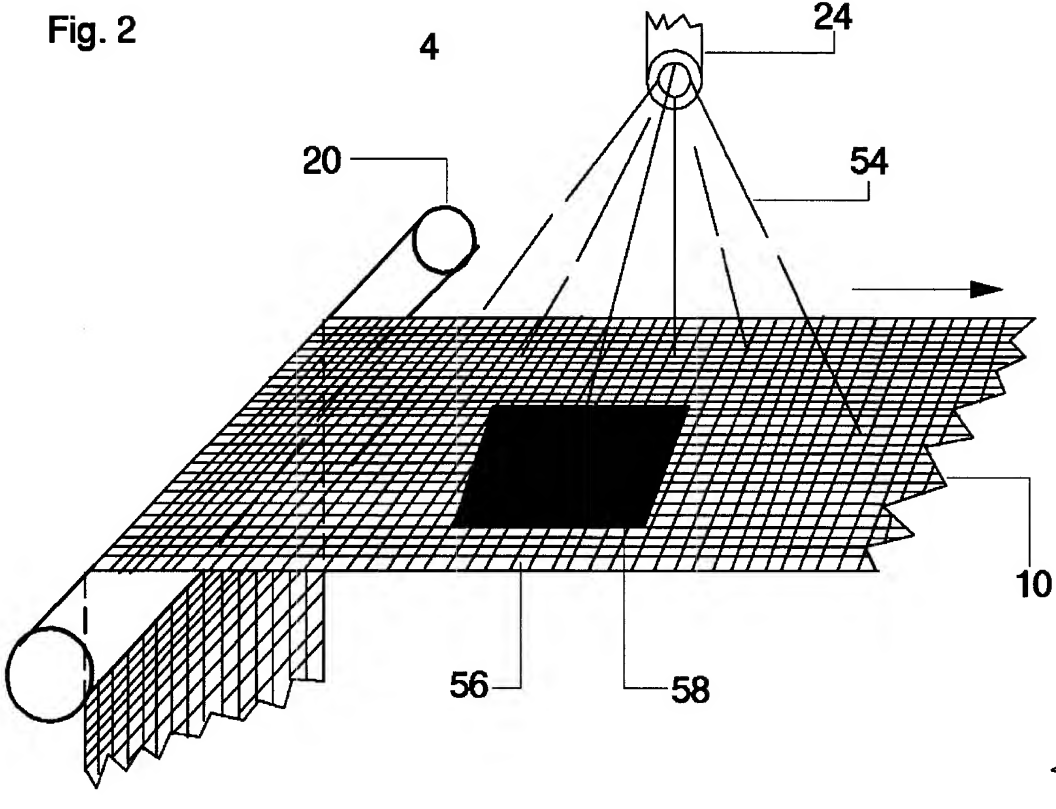
Fig. 2



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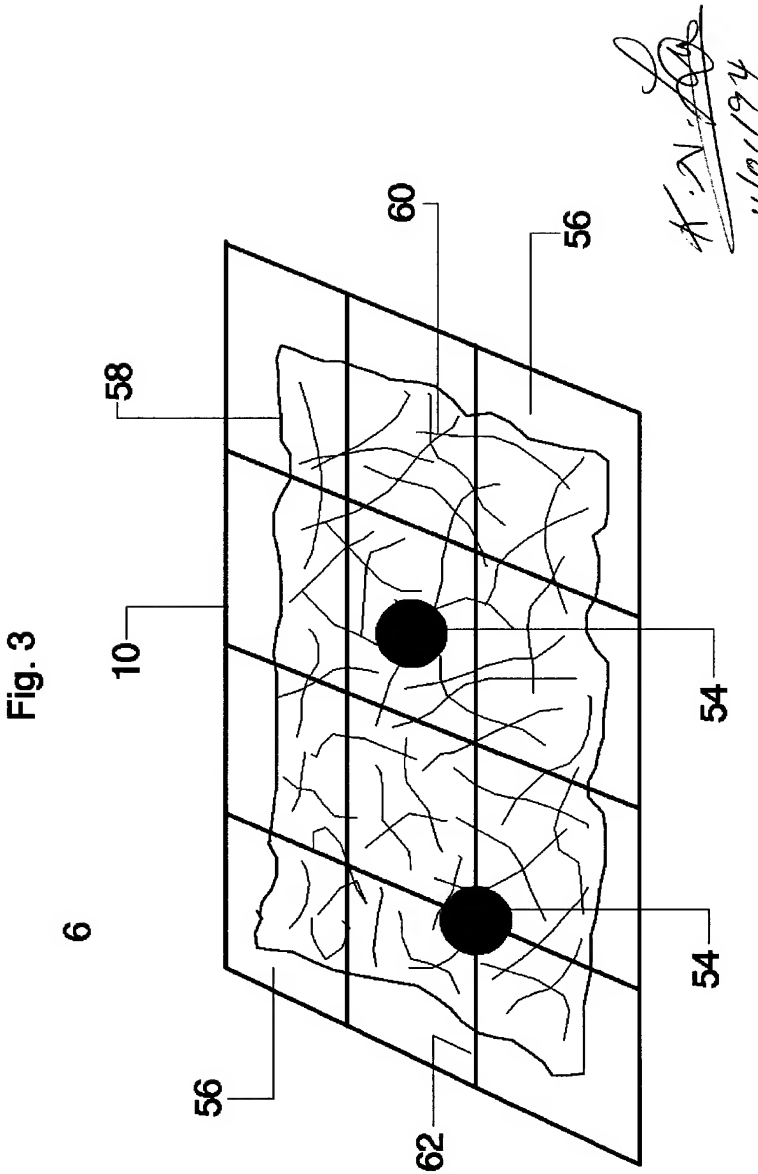

Fig. 3

DERWENT-ACC-NO: 1995-311865

DERWENT-WEEK: 199813

TITLE: De-fiberising bulk waste-paper into individual fibres using multiple rotating water washed screens of different mesh sizes

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PATENT-FAMILY:

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CA 2113737 A	July 20, 1995	EN
CA 2113737 C	January 6, 1998	EN

APPLICATION-DATA:

PUB-NO	APPL-DESCRIPTOR	APPL-NO	APPL-DATE
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CA 2113737C	N/A	1994CA-2113737	January 19, 1994

INT-CL-CURRENT:

TYPE	IPC DATE
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ABSTRACTED-PUB-NO: CA 2113737 A

BASIC-ABSTRACT:

Bulk wastepaper is mechanically defibred in an apparatus having at least two endless rotating screens of different mesh sizes. Included in the apparatus are one or more high impact water jets, one or more high pressure water washing jets, one or more intermediate pressure water washing jets and multiple acceptance and rejection collectors. Mechanised rollers to move the screens and a conveyor to move the bulk wastepaper are also included.

USE - To break up bulk wastepaper into individual fibres.

ADVANTAGE - The apparatus is cheaper to make and run than conventional means and uses no chemicals while still producing good quality fibres.

CHOSEN-DRAWING: Dwg.1/35

TITLE-TERMS: DE FIBRE BULK WASTE PAPER INDIVIDUAL MULTIPLE ROTATING WATER WASHING SCREEN MESH SIZE

DERWENT-CLASS: F09

CPI-CODES: F05-A02B;

SECONDARY-ACC-NO:

CPI Secondary Accession Numbers: 1995-138899